

SOME WINTER WEATHER SIGNS IN UTAH.

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SYNOPSIS.—Five storms in an average winter are of sufficient severity to concern the shepherd or other outdoor worker in Utah; and the meteorological forerunners and advance evidences of these storms are often sufficiently well marked as to enable a careful observer, isolated from access to the daily weather forecasts, to make weather forecasts of sufficient range and accuracy as to assist in the protection of his interests.

An average or typical storm over the Plateau States is described, both from the meteorologist's viewpoint, and with especial reference to the attending phenomena that can be observed in any locality within the field of the storm's influence, by the layman without instrumental equipment, or with limited apparatus. Thus the lone observer, unversed in weather lore, is enabled more intelligently to read the weather signs from day to day.

A number of axioms or the more significant and reliable weather signs furnished by old-time observers in the West, are quoted; and a number of weather proverbs which have been found fairly reliable in Utah are presented, with brief explanations of their relevancy.

INTRODUCTION.

Only twenty out of the hundred days in an average Utah winter bring an appreciable amount of precipitation, considering the State as a whole; and only five bring the equivalent of 2½ inches or more of snow. The atmospheric inclemency during the passage of general storms in Utah lasts from a few minutes to a week or more in any one locality, the average number of consecutive stormy days being two. Thus an abundant opportunity is usually afforded in winter for outdoor activity appropriate to the season, in the cities, the agricultural and mining districts and on the livestock ranges, though this very fact of sustained industrial activity makes the coming of these storms of considerable moment.

Most of these disturbances are indicated on the twice-daily weather maps of the United States Weather Bureau and are mentioned from 24 to 36 hours in advance in the forecasts which are distributed to all places that can be reached promptly; but it is often the isolated industry, solely at the mercy of the weather, such for instance as the ranging of sheep on the remote winter ranges, that is in most urgent need of a foreknowledge of coming storms; and it is this need, growing more acute with the increasing number and value of livestock, the segregation of the range, and with the vanishing of the frontiersman's weather lore, that we hope may at least be partially met in this résumé of weather signs, as well as serving other interests not in touch with the daily weather forecasts.

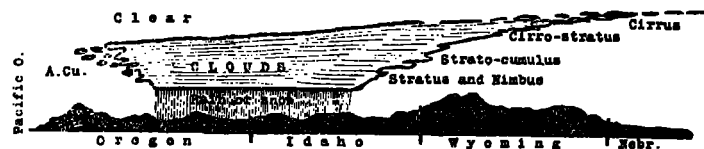
MECHANICS AND MOVEMENT OF STORMS.

Properly to understand any legitimate premonition or sky sign appearing in advance of weather changes, it will be advantageous to examine the mechanics and movement of a typical storm area. Within the great sea of atmosphere flowing eastward continually across this part of the world appear vast maelstroms or eddies of low atmospheric pressure, which interrupt the local course of the winds, vary the temperature and moisture distribution, and cause nearly all the disturbances or storms.

Ordinarily these cyclones or LOWS, as the meteorologist terms them, slowly rotating counterclockwise, with their own systems of winds, and fields of different temperatures, cloud and precipitation, are carried forward with ever-changing features at an average rate of about 750

miles a day, from the time of their appearance off the Alaskan, Canadian, or United States coasts, or, sometimes, in the interior western part of the United States, until lost on the Atlantic Ocean or in Europe or Asia.

These disturbances are so variable, however, in their speeds, their courses, their areas of cloud and precipita-



Cross section of a supposed ideal storm

tion, the intensity of their winds and rates of precipitation and their temperature values, that simultaneous observations are made each morning and evening at a little more than 200 selected places in the United States by Weather Bureau officials so that the forecasters may note what is taking place within the storm and in what direction and at what rate it is moving. On this information the forecasters base their estimates as to what the storm is likely to do in the immediate future.

MOUNTAINS ARE DISTURBING INFLUENCES.

Probably the most disturbing influence encountered by the surface winds about a LOW or storm center is the general topographical elevation of the western portion of the United States. A storm is fed by its winds, and the mountains, interfering with atmospheric movement, interfere also with the normal development and progress of areas of cloud, high temperature, precipitation, low temperature, and fair skies successively, although the disturbance as a whole is little, if any, affected in its rate and direction of progress.

Thus the storm heralds in the form of clouds blown forward like smoke from a forest fire, the increasing warmth and stiffening southerly winds due to the disturbance, and the increasing atmospheric humidity transported from the ocean are more or less interdependent evidences of storm, and are usually unaccompanied by many of the numerous minor signs that appear over the Mississippi Valley and the Eastern States to warn the resident after the storm has crossed the Rocky Mountains.

The companion of the cyclone or LOW is the anticyclone or HIGH, producing the opposite kind of weather, or fair, dry, and cold, with diminished wind movement. Someone has well said: "The weather owes its variety to the LOW, and its reputation to the HIGH." Naturally the winds trend, though by no means directly from a HIGH to a LOW, the steeper the barometric gradient the stiffer the wind; thus the position of the various HIGHS on any weather map, and particularly the so-called sub-permanent HIGHS off the principal pathway of LOWS, in the southeastern North Pacific and interior of Canada (during winter), controls in a large measure the rate and direction of movement of any near-by LOW, and of its own family of winds.

SUCCESSION OF "HIGHS" AND "LOWS."

HIGHS that fall in line, as many do, and follow a progressing LOW, have a decidedly important part to play in furnishing variety to the weather. With the turn of the barometer from falling to rising, that is, at the passing of the center of the low in Utah, the wind whips suddenly from southerly to northwesterly and increases greatly in velocity; the temperature drops very suddenly and precipitation usually begins. The duration and amount of precipitation is dependent largely on the rate of movement and the depth of the low, while the abruptness of the termination of the precipitation, clouds and wind, and the abruptness and amount of the fall in temperature depend on the nearness of the HIGH to the LOW, and on the differences in the lowest and highest readings of the barometer. The normal round or sequence of weather for any locality is subject to still further modification as the storm paths vary in distance from the locality.

When neither a HIGH nor a LOW of importance is near, and conditions are fairly stable in Utah, there are few if any opaque clouds excepting possibly a few in the west toward sunset, though the whitish feathery streaks and streamers of cirrus and cirro-stratus, or high, upper clouds, apparently painted onto the blue sky, may be more or less numerous from time to time owing to distant disturbances, or, frequently, to some local conditions.

STABLE WEATHER ROUTINE.

Stable weather also requires a temperature routine reaching a minimum about sunrise and a maximum about mid-afternoon with a gradual trend toward these culminations in the meanwhile; and a maximum relative humidity about sunrise and a minimum about mid-afternoon. The wind also reaches a maximum velocity in mid-afternoon and a minimum in the early morning hours. There is in some Utah districts, notably at Salt Lake City, a light southerly drift from about 10 p. m. until about noon the following day, with a northwesterly trend during the afternoon regularly, as the great easterly stream aloft imparts its velocity and direction through convectional currents to the surface winds.

Any important interruption of this routine is usually an evidence of the proximity of a storm. The rate of the increase in cloudiness, the rate and amount of the abnormal rise in temperature, and the steadiness and velocity of the southerly wind, and the increase in humidity are rough measures of the nearness of the storm. If the wind suddenly backs into the northeast with vigor, as it sometimes does in adjacent parts of Idaho and Wyoming, the storm center is passing to the south of the observer and severe weather usually follows quickly.

The true chinook seldom occurs in any part of Utah, hence the increased warmth at an unusual hour is nearly always the result of a near-by storm. During the prevalence of snow cover the humidity conditions may be misleading; and if the observer is just outside the path of the precipitation area, all the evidences of the storm, except the precipitation, will be experienced, though with diminished intensity.

SIGNIFICANCE OF BREAK IN ROUTINE.

If the temperature does not fall on a clear, quiet night it is usually a sign that an invisible blanket of moisture is not far above the surface of the earth, being a lofty

forerunner of storm, checking the rate of radiation from the earth. If at the same time the wind is gaining speed slowly, and coming steadily from some southerly quarter, rain or snow is pretty sure to follow soon. Usually when a storm of considerable intensity is approaching, but still three or four days distant, there is a cessation of the normal eastward atmospheric flow from the Pacific Ocean across Utah, and a resultant decrease in humidity. The humidity will become particularly low, with unusually high temperatures on about the third or fourth day prior to the storm. As the storm approaches, particularly if its center is about to pass to the north of Utah as most of them do, the humidity will then run above the average, being especially high on the day before the storm.

As long as the cirrus or cirro-stratus clouds only partly obscure the blue sky the storm is still usually more than 24 hours distant, no matter how the other signs read. The cloud field becomes lower and denser until the texture on the lower surfaces of the stratus and stratocumulus clouds appears coarse; then when the cloud roof shows no seams or breaks, the precipitation is very near.

If the cirrus paving begins and later grows less the precipitation area will probably miss the observer, but if the cirrus or muslinlike sky thatches over like sheet silk, and the blue sky disappears entirely, the storm is approaching the observer more directly. The rate of change from upper or feathery, to lower, dense clouds is to a certain extent a measure of the rate at which the storm is approaching. The cirrus streaks or bands may trend in any direction, and the entire cirrus mass may be drifting (with the wind, of course) in any direction, but only when the cloud lines trend in east-west or southeast-northwest directions, and move longitudinally (not sidewise), do they seem to connect up more definitely with a storm that may concern the observer. These cirrus fronds are not usually many hours in evidence before the cirro-stratus obstruct the blue entirely and the sun (or moon) grows pale; then come the lower clouds, and the storm.

SOME CHARACTERISTICS OF THE HIGH.

The clear, crisp exhilarating atmosphere in the anticyclone or HIGH, without the cloud or moisture blanket aloft to check radiation from the naked earth at night, induces abnormally low temperatures. A good blanket of snow covering a large area, being a good radiator, tends to build up a HIGH and to retard or temporarily to prevent its movement. If a clear winter day does not warm up normally, a HIGH or cool wave is near, and the coming night will be colder than the preceding one as a rule.

The coldest part of an advancing HIGH, or the coldest time after a storm, comes after the maximum importation of cold air at the rear of the storm by the northwesterly winds has occurred, and the cloud and the moisture covering aloft has been drawn away exposing the land to intense radiation. This is often the second night after the storm, depending somewhat on the time of day the cloud layer goes away, and on the size of the HIGH.

The snow layer over which a HIGH sometimes recruits its strength also favors the formation of local fogs; there is also a tendency within the unagitated cold midst of a HIGH for morning fogs to form without the aid of the snow layer to provide the cold and moisture. Therefore, as long as the morning fogs continue, fair weather is assured; but after a series of foggy mornings, if the fogs are absent, the HIGH is waning or moving out. The HIGH often causes the fog to rise, or move up the slopes; therefore, if the snow cover or other causes have induced fogs that are

still lingering locally, and are found to be moving down the slopes, it is usually proof that the pressure is falling with the approach of a storm center of some kind.

DETECTING THE CLEARING SKY.

Sometimes one disturbance is followed very quickly by another so that the clearing between them does not present the normal sequence of weather elements attending the more isolated storms. Usually the storm begins to wane, the wind to slacken, and the snow to lessen, and finally ends entirely with a clear sky before the crest of the HIGH has arrived. Thus, the more energetic storms break away and clear up once for all.

If it is clear in the afternoon or evening, leaving a deep blue sky, there will be a cold night, usually the earlier the clearing the colder the night. A great many storms end in the night, in which case the morning clouds, after the storm, are usually of the lower cumulus type, with soft loose edges, and often in a general orderly arrangement across the sky. They are low and seem to be running rapidly. Between them the sky is blue-black and clear, showing nothing above them. If they are coming from the northwest there is some cold weather to follow, but if from the southwest the approaching HIGH and its attendant cold are much less important. A temporary lull in the storm is often easily detected as the sky is less bright, and there is a greater variety and depth of cloud, than in a truly clearing sky. Even before the sky is visible, the soft mosaic-like clouds will show yellowish edges where the sun shines through.

SOME LOCAL SIGNS IN UTAH.

The signs of the coming and the passing of storms are bound to differ somewhat for different localities in the State because of the topographical differences; therefore, each observer will need to learn something of the local evidences of storm in his own locality. A large number of outdoor men have been interviewed on this subject, and some of the information has been incorporated in the foregoing pages; however, a few typical local signs, which may be applicable to other Utah regions and in adjacent States, are given herewith.

Mr. Walter James, of Government Creek, Tooele County, says he has noticed that coronas and halos indicate that a storm is brewing, but the occurrence of the storm at that place is not certain. Sundogs usually precede cold weather, the brighter the spots the lower the temperature; also the more numerous the spots the more severe the cold. If smoke from the chimney falls to the ground a storm is brewing, though this is not a certain sign of storm. Cattle and horses at large on the range will sometimes seek shelter at unusual hours in advance of a storm.

Mr. George McCune, of Mills, Just County, but for many years a herder over western Utah in winter, says storms are always preceded by a strong wind pressure from the southwest; this wind continues sometimes for a week and sometimes for only 24 hours. When the time is short the storm is sure to be severe, and it will usually be a one-night affair, followed by fair and cold weather the next day. The longer the blow the less severe the storm, though more precipitation may come from the slower storms. Before a storm, the clouds must also come down low, and be near and dark.

Mr. Samuel W. Western, of Deseret, Millard County, says that whenever a cloud settles down on a high peak in Antelope Mountains, some 30 miles to the west of Deseret, a storm is sure to follow. An extra-warm day is a sign of storm, especially if the wind blows from the south a day or so. "I will also refer you to the Bible" writes Mr. Western, "Matthew, 16th chapter, verses 1-3, which applies to this region also: 'He answered and said unto them, when it is evening, ye say, it will be fair weather; for the sky is red. And in the morning it will be foul weather today, for the sky is red and lowering.'"

Mr. Alex Matheson, of Parowan, says there will be rain or snow within 24 hours if the sun sets behind a heavy, black cloud.

Mr. Moroni A. Smith, of Salt Lake City, with a long experience on ranges of western and eastern Utah, notices that after it has stormed a few days the weather does not have to do so much threatening to produce precipitation as for the first storm after a long dry spell.

Mr. A. A. Covey, of Salt Lake City, writing of conditions in southwestern Wyoming, says: "The north-east blizzards are the worst and coldest storms, which drive all unsheltered stock before them. Only three or four such storms occur in a winter. We don't get much northeast wind unless a bad storm is coming. There isn't much warning in the clouds, except that the storm usually follows low drifting clouds, and they occur after a break or warm spell; thawing weather in January always means a storm. Before a storm sheep appear to feel frisky, and they buck and kick up considerably; horses play also. When it is warm in the morning we expect to see water running before night. It gets extremely cold when the entire country is blanketed with snow, and the sky turns off clear and still."

Mr. Thos. W. James, of Salt Lake City, ranging for many years out of Rock Springs, Wyo., says a west wind for 2 or 3 days will fetch a storm; if the wind begins from the north during the storm, it will clear up and get cold, though sometimes it gets cold without much north wind. The worst storms are when the wind gets around into the east and blows hard. It gets terribly cold in a very short time, these being by far the worst storms. The cattle travel around a good deal in all directions, and bawl for one or two days, and coyotes yelp a good deal both day and night, before a hard storm; sheep also jump about considerably."

SOME PROVERBS FOR WESTERN WEATHER.¹

In most thickly settled regions of the Eastern States where the weather sequences are more definitely marked the weather signs are rather well and favorably known; and thus a beautiful and more or less truthful lore has grown up about the ways of the weather. But many proverbs,² originally good, have been transported by a migrating people to regions where they do not apply, a fact of increasing importance over the western Plateau States, where the atmospheric signs require the most corroboration. Many other well-phrased sayings have no place at all in meteorology, such, for instance, as those referring to the phases of the moon, the significance of conditions on any particular day, or any other totally disconnected phenomena.

¹ Weather Folklore and Local Weather Signs, by Edward B. Garriott, Weather Bureau Bulletin No. 294.

² Some Weather Proverbs and Their Justification, by W. H. Humphreys, Ph. D. Popular Science Monthly, May, 1911.

Of the vast number of weather proverbs in existence, however, a few have been found more or less applicable to weather sequences in Utah, in addition to those already incorporated in the foregoing pages. The human manifestations of lassitude, indolence, and inactivity, for instance, are associated with warm moist weather and abnormally low atmospheric pressure, especially in the winter, following a spell of high barometer when the air has been dry and sunny, which tends to electrify and to stimulate. Similar physiological conditions are also manifested by many animals.

Men are apt to sleep better, eat more, and be more energetic when the barometer is high. Sheep ascend the hills and scatter in advance of clear weather, but they bleat and seek shelter before a storm. Old sheep are said to eat greedily before a storm and sparingly before a thaw; but when they leave the high ground and bleat much in the evening and during the night, rough weather may be expected. Fires in stoves usually burn less readily, lacking draft, when the barometer is low; at these times perhaps because of the moisture absorbed by the hygroscopic smoke particles, the smoke falls to the ground and the morning fogs move down the ravines. Fogs move up the slope and fires burn with a better draft when the pressure is high. Birds usually fly low when the barometer is low, and many of them fly high in high barometer. When snowbirds gather in flocks and alight on fences and hedges the proverb says, expect a storm.

EVIDENCES OF CHANGING HUMIDITY.

The increasing humidity in the general atmosphere is manifested in many ways other than by clouds. And in case the storm center is passing well to the north of the observer, he may expect the increase in humidity to be followed by a decrease, usually, as the storm influence wanes. Thus, when cumulus clouds are smaller at sunset than at noon, the tendency is for fair weather; and if the cirrus clouds dissolve and vanish, fair weather is indicated. All humidity indications must be pronounced to be dependable in this region. It is not sufficient for the cat to sneeze, and the dog to grow lazy, though these may often be evidences of increasing humidity and temperature and falling pressure; the latter and not the former are the real weather breeders.

Such articles as smoking tobacco and table salt often show this humidity variation; and an oil lamp or lantern may not burn so brightly or lustily in damp weather; the flame snaps and crackles and a sort of fungus excrescence grows from the wicks and the oil is consumed slowly. While the temperature may be trending upward, but is still well below freezing in the early morning the valley frosts will be much whiter and more profuse because of the increased humidity. Odors are more noticeable in a humid atmosphere because perhaps less readily oxidized and dissipated in the more stable and uniformly moist air. For this same reason sound travels farther in a humid air.

Snow crystals in the upper atmosphere, also a forerunner of storms to a certain extent, produce halos or rings around the sun and the moon, by refraction. The Zuni Indians had a saying that "When the sun (or moon) is in his house it will rain soon;" also, referring to its illusive appearance, "The bigger the ring the nearer the wet."

Local views near the earth are made plainer by a moisture-laden, quiet atmosphere, yet moisture aloft interferes with light waves from the sun, moon, and stars,

because of the varying atmospheric density, and the varying amounts of moisture. Small stars are thus blotted out entirely, and the larger ones have burrs around them. Since this makes it appear as if the stars were getting together the proverb has it, "When the stars begin to huddle the earth will soon become a puddle," or a snowdrift, we might add. A night sky well sown with stars is considered a fair-weather sign. "A clear moon is a frost moon;" that is, if it is sharply outlined, there is less moisture aloft, and without the moisture blanket the naked earth will grow cold. "Sound traveling far and wide a stormy day will betide" and "The farther the sight the nearer the storm" are proverbs that usually pass as legal tender here.

SKY COLORS AND THE WEATHER.

That oldest and most universally applicable of weather signs which concerns the morning and evening sky colors is fairly reliable in Utah, provided there are good corroborative signs. Even the casual observer can soon learn how to note the intensity and shade of colors about the sun and about the edges of the clouds toward the sun that are significant, for they are usually distinctive.

The great amount of red showing in the sunlight when the sun is near the horizon is due to absorption and interference with the light rays by the heavier dust particles in the lower portion of the atmosphere; also to the dust particles which have become greater in apparent size, due to the condensation of globules of moisture upon them. Without this moisture the dispersion of the bluer rays would be less important and the reds reaching the observer less predominant and brilliant.

A red sunset therefore means that the rising air currents during the warmer part of the afternoon have only at these maximum heights been so cooled that their dust particles show incipient condensation of moisture; that is, that moisture is not very abundant in the atmosphere. The sun setting in a glowing horizon as a big ball of fire, looking like so much new gold, followed by colors slow to fade, is thus a fair-weather assurance.

A red sunrise means that at that time, which is the coolest part of the 24 hours, when there is least convection or lifting of vertical currents by the action of the sun, the air is, nevertheless, more or less laden with moisture. During the ensuing day these lower dust particles will be lifted still higher on the wings of the vertical winds for further condensation, a condition necessary for precipitation. Some proverbs pertaining to these conditions are: "Evening red and morning gray are two sure signs of one fine day." "An evening gray and morning red will send the shepherd wet to bed." "Sky red in the morning is the shepherd's sure warning; sky red at night is the shepherd's delight."

Probably a single one of these signs without the others would not be sufficient to justify a prophecy, but when many signs point somewhat definitely toward a change in the weather, such as have been enumerated, the prophecy is reasonably reliable. Forecasting the weather from local signs only must forever remain much less accurate and of much shorter range as a rule than forecasting from telegraphic reports, yet the casual observer, noting the habits of the wind, the unusual temperature, the humidity variation, the rising or falling air pressure, and the general aspects of the sky, should be able, fairly accurately, to anticipate practically all of the more severe winter storms in this region and to fortify his interests against them.